Water Supply Management System And Social Capital

Volume 3

Kiyoshi KOBAYASHI
SURJONO
Ismu Rini Dwi ARI (Editors)

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Kiyoshi KOBAYASHI, SURJONO, and Ismu Rini Dwi ARI

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preface

This book is a third volume from the series of international conference initiated by the Kyoto University GCOE program "Global Center for Education and Research on Human Security Engineering for Asian Megacities," which launches a network of global academic research partnerships among Asian countries since 2008. The book contains 31 selected paper of "The Third International Conference of Water Supply Management System and Social Capital " and funded by the Kyoto University GCOE program.

The third international conference on Water Supply Management System and Social Capital was held on March 21-22, 2011 at Widyaloka Building of Brawijaya University, Malang, Indonesia. The conference presented 42 selected papers and attended by 250 participants covering scholars, practitioners, undergraduate and graduate students from Indonesia, Singapore, Japan, Korea and India involved in the warm sharing knowledge and experience. The purpose of the book is to share theoretical and practical knowledge of water supply management system and social capital by providing a variety of issues of water supply and management in developing countries, as many cases exemplifed in this book occur in Indonesia and other developing countries. The book is divided into 6 parts, covering 1) collective action and water governance issues; 2) social and management issues in water provision and distribution; 3) other sustainability issues of water supply and services, 4) methods and measures for water demand and supply, 5) regulations and policies for water use, and 6) techniques for monitoring water qualities.

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Chapter 20

Determination of Basic Water Need Per Liter/Person/Day in The Consumption of The Type of Real Estate And Village Housing

Dian Noorvy Khaerudin

20.1 Introduction

Water is a primary need which its demand increased in the same line with the development of human culture therefore the determination of water which is spread evenly between dry and rainy season encourages people to fgure out this problem by estimating the number of water in liter/person/day appropriately and effciently to support the territory planning.

This research took the data by questionnaire and collecting strokes/receipts of the fee-paid of the company. The data were taken by free-paid strokes because the measurement tool of number of water was used every month. PDAM has the distribution of that measurement tool; developer has also that measurement tool for real estate housing.

The result of data analysis was verifed by observing the determination of water need which had decided, it was like Dinas Cipta Karya's decision based on the number of inhabitant; PDAM had also decided based on the data showing the monthly use.

The aims and uses of this research were:

Aims:

1. To fnd out and probe the basic water need per liter/person/day for the use of kind of real estate housing;
2. To fnd out and probe the basic water need per liter/person/day for the use of kind of village housing;
3. To fnd out and probe the basic water need for city group such as Malang City.

The advantages of this research were:

1. Could give a clarifed data for the basic water need of city type.
2. Could give a recommendation for the water availability which had to fll the water need.
3. Could be a reference for the save for water program.

20.2 Review Of Related Literatures

The basic water availability system needed to take into account a forecast of basic water need per year. According to the reference decided by Directorate of Public Works in the basic water calculation it is said that the need analysis of basic water consists of several basic water needs as follows:

1. Domestic water need is water needed to house need and other needs. The amount is determined by the characteristic and development of basic water use in domestic use for basic water.
2. Non-domestic water need is all basic water need included water availability for social or public such as school, praying house, hospital, offce, and also commercial interest such as industry, hotel, and public service. The non-domestic water need is about 20%-30% from the domestic need.

In this research there would be a discussion about domestic water need in the use of house living type i.e. real estate housing and village housing in Malang because it is well known that this area have just developed real estate and kept end up the village housing.

Real estate housing defnes as a housing area developed by a developer. Village housing defnes as a housing area which is not developed by a developed so that the effort to develop it will be done by the residents.

(Offcial Regulation of Republic of Indonesia N0. 16 about Drinking Water Sup - plying System). The value of basic water need for house connection type could be explained by this following table.

Table 20.1 To fnd out the water need of house connection type

No	Clean City Category	Note	Number of Residents	Water Need liter/person/day
	Category I	Metropolitan City	More than 1 million	190
	Category II	Big City	500,000 - 1 million	170
	Category III	Medium City	100,000 - 500,000	150
	Category IV	Small City	20,000 - 100,000	130
	Category V	Village	10,000 - 20,000	100
	Category VI	Small Village	2,000 - 10,000	60

Source: Policy Reference of Infrastructure Development Program of Intergraded City (P3KT) Repelita V Dirjen Cipta Karya, 1995

According to R. K. Linsley, Teknik Sumber Daya Air, it is stated that basic water need per liter per person per day is infuenced by some factors such as:

1. Climate
2. Life style

The amount of basic water need is different between one residence to another; it depends on the utilization of land and development of the city.

The data taken as the sample of water need was from collecting strokes/receipts of fee-paid depended on time.

The minimum time for record-keeping was monthly which was easy to be recorded by recording machine in the drinking water supplying company.

The percentage of use for yearly calculation was got from the monthly recording as follow:

$$Sp = 100 - (Mp \times 12) \quad 1)$$

Which:

Sp = percentage of yearly use

Mp = percentage of minimum monthly use

The amount of use of certain time was formulated as follow:

$$Qc = \frac{0.5\ Qb}{N} + \frac{0.5\ Qb}{N} + \frac{1}{N} \quad 2)$$

Which:

N = amount of month

Qc = amount of water use during monthly calendar

Qb = amount of water use in recording of strokes/receipts of fee-paid

(Larry W. Mays, 1996)

20.3 Research Method

This research used surveying method. The survey was based on statistics so that to collect information in order to decide the water use per liter/person/day it had to take into account the effciency. The statistic method used was proportional random sampling. Whereas the survey method used as follows.

a. Quantitative survey method, it is survey method to collect data presenting in form of physical form of irrigation water use by farmers. The result expected from this method was some tables containing number or percentage as the output of questionnaire. The minimum limit of sample used was as follow.

$$n = \frac{N.CL.(CV)^2}{N.r^2 + Cl.(CV)^2}$$

$$r = 1 - \left| \frac{y - Y}{Y} \right|$$

$$CV = \frac{SD}{Y}$$

Which:

n = amount of minimum sample
N = amount of population
Cl = standard of, for 95% of belief level, so Cl=1.96
CV = standard of homogeneity, Coeffcient of Variation
R = relative mistake
y = average sample
Y = average population
SD = Standard of Deviation

b. Qualitative survey method, principally the base to calculate the number of sample is as same as quantitative data. The main difference is in classifying respondents' opinion qualitatively.

20.4 Data Collection

The data was gained by collecting strokes/receipts of fee-paid from PDAM because almost the water consumption in Malang uses still distribution service organized by PDAM.

The strokes/receipts of fee-paid were taken for the consumption in some times i.e. consumptive month so that it could be known the average of the consumption from the recording meter printed on the strokes/receipts of fee-paid.

The primary data gained from questionnaire was used to determine the parameter of the household water need such as water need for bathing (could be seen from the type of bath tub), wide of land for plants, ownership of motorcycle and car, consumption of drinking water (consume gallon or self cook water). The data was

taken for the consumption of real estate and village housing type. The frst step for data collection was determining the criteria of real estate and village housing in Malang City.

20.5 Results and Discussions

Malang City consists of fve (5) districts and each district has some villages admin - istratively as follows.

1. Klojen District 12 villages
2. Kedungkandang District 11 villages
2. Lowokwaru District 12 villages
3. Blimbing District 11 villages
4. Sukun District 11 villages

Source: BPS of Malang City, 2009

Water need for basic water will not decrease. The debit needed by society will increase more and more so that if the debit decreases, the human need will not be reached. The data about amount of residents and its projection Malang City can predict the basic water need projected to fll Malang City's need.

The amount of Malang City and household as the explanation of this research could be explained by the data of Board of Statistic Center of Malang City in 2010.

Table 20.2 Number of households, residents, ratio of sex, and average of number of household's member as the result from census in 2000

No.	District	House-hold	Residents			Ratio of Sex	Aver-age of House-hold's Member
			Male	Female	Amount		
1	Kedungkan-dang	44,862	74,546	75,716	162,941	98,45	3.6
2	Sukun	46,250	80,696	81,399	175,772	99,14	3.8
3	Klojen	36,458	55,850	61,650	127,415	90,59	3.5
4	Blimbing	44,937	78,514	80,042	171,935	98,09	3.8
5	Lowokwaru	77,317	85,498	83,072	182,794	102,92	2.4

Source: Kota Malang dalam Angka, 2009

Malang City as a tourism and educational city indicates that the more increas-ingly the amount of residents, the more hugely the need of tool and infrastructure. This case is proved by there are so many real estates in Malang City. The growth of real estate in Malang City is high in each district in such way that real estate have transformed its function to be residential housing (village housing) since there is nothing intervene from developer in managing that housing.

The management of developer purposed is the process during building the housing until management in providing infrastructures and basic water. Developer gives still services toward providing basic water that is by giving the monthly bill of basic water use for each house. The recording medium is given by developer as the effort to measure the amount of consumption of basic water for each house per month.

This research took the kind of real estate and village housing as the samples. The water availability provided by PDAM covered all fve districts therefore the samples was taken by random sampling on each district both in village and real estate housing.

The data of type of house and wide of land were collected by doing interview to each area manager, RT and RW (neighborhood association), developer, and society or residents.

Village housing has more varied characteristics of type and wide of land than real estate type which has wider land and same model of house.

Those data was got from the result of random survey using questionnaire by investigating every single district/area. There were 99 questionnaires were allotted at village housing and 101 questionnaires were allotted at real estate housing during 7 months. As information that 8 months planned in the proposal could not be implemented because the one month implementation was blocked by administrative affairs.

The calculation for basic water need from m^3/month became liter/person/day. The water usage in 1 month was 26 m^3; member of 1 household was 6 people; so that the water consumption in liter/person/day was:

$$144.44 \frac{\frac{lt}{person}}{day} = \frac{\frac{26}{30} \times 1000}{6} person$$

Then each house was calculated from the average of 7 months usage; and the average of water consumption of each district/area. The water consumption in m3/ month next would be set as the water need per liter/person/day in which this standard became the basic determination of mainstay water availability.

20.6 The Recapitulation of Water Need Per Liter/Person/ Day for The Type Of Village Housing And Real Estate in Malang City

Water is a primary need which its demand increased in the same line with the development of human culture therefore the determination of water which is spread evenly between dry and rainy season encourages people to fgure out this problem.

This research presented the data of type of house and sex of residents. The type of house at least could fnd out whether there were effects of basic water consump - tion in m^3/month to the type of house of each household. Next for the data of sex,

this data would show whether sex infuenced consumption of basic water m ^{3}/month or not. This case was based on a statement that lifestyle can infuence water need per m^3/month or liter/person/day.

Table 20.3 Recapitulation of water need per liter/person/day for the type of village housing in Malang City

No.	District	Water Need per liter/person/ day
1	Kedungkandang	124.88
2	Sukun	129.77
3	Klojen	116.41
4	Blimbing	141.14
5	Lowokwaru	177.52

Source: The Result of Researcher's Data Analysis

So that the average of basic water need per liter/person/day of the type of village housing in Malang City was 140.30 liter/person/day.

Table 20.4 Recapitulation of water need per liter/person/day for the type of real estate housing in Malang City

No.	District	Water Need per liter/person/day
1	Kedungkandang	121.63
2	Sukun	165.70
3	Klojen	147.70
4	Blimbing	158.17
5	Lowokwaru	130.73

Source: The Result of Researcher's Data Analysis

So that the average of basic water need per liter/person/day of the type of real estate housing in Malang City was 145.45 liter/ person/ day.

From the data analysis above it could be known that the water need for the type of village housing was 137.9 liter/person/day, the highest consumption was at Sukun District and the lowest was at Lowokwaru District, whereas for the type of real estate housing was 144.78 liter/person/day, the highest consumption was at Blimbing District and the lowest was at Kedungkandang District.

Malang City is one of sub development area in East Java region. It has a function as a connector line to connect some potential territories in order to building a new order city. One of the ways is by building Malang City itself to be a connector line of education and tourism city. Next, Malang City widens its access of road and residence to fll the increase of population of settle and seasonal residents of Malang City, the seasonal residents were residents coming in Malang just for studying, working, having tour, and investing.

This case could give a discussion that the water need per liter/person/day for village and real estate housing was not different. The difference was the type of housing, type of house and wide of land, and variation of house, village housing was more varied than real estate housing though the difference was not far.

From the beginning observation, water need is a domestic and non-domestic water need, in the other words the need used every day, therefore the average need for Malang City after all this time was calculated by the average consumption monthly from PDAM of Malang City, the data were:

1. The development of average consumption showed that the highest consumption was 20.74 m^3 or 138.27 liter/person/day in which the amount of consumption was for 5 people.
2. The development of average consumption showed that the lowest consumption was 17.84 m^3 or 118.93 liter/person/day in which the amount of consumption was for 5 people.

If it was forecasted by using the standard of water need per liter/person/day from Dirjen Cipta Karya and based on the total of population of Malang City showing 807,136 people in 2006, the prediction of basic water need per liter/person/day for Malang City was categorized at Category II of Big City *i.e.* 170 liter/person/day.

This research was given score for Malang City *i.e.* 142.8 liter/person/day. This case was supported by the data of the total of population and wide of land of Malang City. This score could streamline the prediction of water need per liter/person/day for the prediction of water availability in Malang City by comparing with the prediction data based on the total of population of big city *i.e.* 170 liter/person/day.

This research could give a discussion that there should be a determination of water need per liter/person/day based on the city's characteristics which would be planned. These characteristics were total of population, total of residents per household, and stages of city development. Furthermore, another area having same characteristics could use an area which had been researched as a reference of water need per liter/person/day. For instance, Ende Regency which has the same characteristics with Malang City in total of population, total of residents per household, and stages of city development would had the same research result of the water need of Malang City, the result was almost same *i.e.* 141.77 liter/person/day.

20.7 Conclusions and Suggestions

(1). Conclusions

Water is a primary need which its demand increased in the same line with the development of human culture therefore the determination of water which is spread evenly between dry and rainy season encourages people to fgure out this problem. The basic water need and availability for society's need of Malang City needed a clarifed data to fnd out the basic water need of society of Malang City.

If the basic water need was adequate, the water debit needed by society having high increasingly needs was high. In the other words, if the water debit decreased, the human needs would be not covered completely. In order to maintain the basic water need and availability in balance, not decrease, the basic water debit needed by society needed to be limited, this aimed to make the water debit as the water need in every time need.

The result of analysis and discussion showed that:

1. Water need liter/person/day for village housing was 140.30 liter/person/day with inhabitant in each house in average was 4.4 (four point four) people.
2. Water need liter/person/day for real estate housing was 145.45 liter/person/day with inhabitant in each house in average was 4.3 (four point three) people.
3. Water need liter/person/day for Malang City was 141.77 liter/person/day with inhabitant in each house in average was 5 (fve) people.
4. The water need per liter/person/day which had the same characteristics like Malang City (140 liter/person/day) for instances Ende Regency and Cirebon City.

(2). Suggestions

There were some suggestions given as follows.

1. There should add some distribution networks.
2. There should add some house connections since the water availability was still able to produce 30% from the water resource existing.
3. There should conduct a socialization program to society in order to save water actively.
4. There should be cooperation between HIPPAM (*Himpunan Pemakai Air* / Water Consumers Association) and PDAM.

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Water Supply Management System And Social Capital

Volume 3

Edited by : Kiyoshi KOBAYASHI, SURJONO, and Ismu Rini Dwi ARI

This volume contains of the 31 examined and selected papers of the 3rd International Conference on Water Supply Management System and Social Capital, held on March 21-22, 2011 at University of Brawijaya, Malang Indonesia. Consisting of thirty two chapters covering four themes :

- social structures and institution in community
- water right and water governance
- community managed water system
- sustainable water management

The wide range of discussion in the book provides a fruitful reference to readers on both theoretical research and empirical practices in the field.

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